

CRITICAL PATH ROADMAP DISCIPLINE(S)	PRIMARY SPECIES / TYPE	GROUND EXPERIMENT TITLE	NASA OBPR - TASK BOOK							
			Year Experiment Was Listed in Book							
			1995	1996	1997	1998	1999	2000	2001	2002
Bone Loss	Animal	Activation, Adaptation, Restoration of the Mechanical Response of Osteoblasts to Fluid Shear							2001	2002
Bone Loss	Animal	Architecture and Mechanical Function in Bone with Recovery from Disuse Osteoporosis		1996	1997	1998	1999			
Bone Loss	Animal	Biochemical Changes of Bone in a Model of Weightlessness	1995	1996	1997	1998				
Bone Loss	Animal	Bone Adaptation to Precisely Controlled Cyclic Loading							2001	2002
Bone Loss; Muscle Alterations & Atrophy	Animal	Bone and Muscle Recovery after Simulated Microgravity							2001	2002
Bone Loss	Animal	Bone Blood Flow and Simulated Microgravity; Bone Blood Flow During Simulated Microgravity: Physiological and Molecular Mechanisms				1998	1999	2000		
Bone Loss	Animal	Bone Matrix Changes During Skeletal Unloading and Reloading				1998	1999	2000	2001	2002
Bone Loss	Animal	Do Integrins Mediate the Skeletal Responses to Altered Loading In Vivo?						2000	2001	2002
Bone Loss	Animal	Elucidating the Molecular Events of Bone Mechanoreception							2001	2002
Bone Loss; Food & Nutrition	Animal	Glucose-dependent Insulinotropic Peptide as an Osteoprotective Agent during Space Flight							2001	2002
Bone Loss	Animal	Gravity and Bone Growth	1995	1996	1997					
Bone Loss; Immunology, Infection & Hematology; Clinical Capabilities; Muscle Alterations & Atrophy	Animal	Healing Response of Injured Rodent Knee Ligaments to Hindlimb Unweighting and the Therapeutic Efficacy of Growth Hormone (This Task began in FY2000)					1999	2000	2001	2002
Bone Loss	Animal	Leptin as a Regulator of Bone Formation in Microgravity							2001	2002
Bone Loss	Animal	Mechanical Load Effects on Bone Formation; Rice NSCORT in Gravitational Biology: Mechanical Load Effects on Bone Formation				1998	1999	2000		2002
Bone Loss	Animal	Microgravity In Vitro Model of Bone Cells: Flow Effects; Microgravity In Vitro Model of Bone: Flow Effects	1995	1996	1997	1998	1999	2000		
Bone Loss	Animal	Modulation of Bone Remodeling via Mechanosensitive Channels	1995	1996	1997	1998	1999			
Bone Loss	Animal	Molecular Mechanisms Regulating IGF-I Synthesis in Bone	1995	1996	1997	1998	1999			
Bone Loss	Animal	Negative Regulation of Osteoclastogenesis by Estrogens via Direct Actions on Hematopoietic Cells					1999	2000		
Bone Loss	Animal	Novel Receptor-Based Countermeasures to Microgravity-Induced Bone Loss				1998	1999	2000		
Bone Loss; Muscle Alterations & Atrophy	Animal	Optimization of a Biomechanical Countermeasure for Disuse Osteopenia; Optimization of a Biomechanical Countermeasure for Disuse Osteoporosis			1997	1998	1999	2000	2001	
Bone Loss	Animal	Osteoblast Integrins and Osteoblast Function in Low Gravity			1997	1998				
Bone Loss	Animal	Osteoblast Regulation by Mechanical Stimuli via Gap Junctions						2000	2001	2002
Bone Loss	Animal	Osteoblastic Response to Gravity in Transgenic Mice	1995							
Bone Loss; Clinical Capabilities	Animal	Pharmacological Intervention to Prevent Disuse Osteopenia		1996	1997	1998	N/A	N/A	2001	2002
Bone Loss	Animal	Posture Load-Induced Bone Maintenance: A New Hypothesis (split with Frangos)	1995	1996						
Bone Loss	Animal	Pre-Metatarsal Differentiation and Mineralization				1998	1999	2000	2001	
Bone Loss	Animal	PTH Modulates the Response of Osteoblast- like Cells to Mechanical Simulation				1998	1999	2000		
Bone Loss	Animal	Receptor Countermeasures to Bone Loss in Microgravity							2001	2002
Bone Loss	Animal	Resorption suppression and bone health disuse							2001	2002
Bone Loss	Animal	Role of Integrins in Mechanical Loading of Osteoblasts	1995	1996	1997	1998	1999			
Bone Loss	Animal	Skeletal Collagen Turnover by the Osteoblast	1995	1996	1997	1998				
Bone Loss; Clinical Capabilities	Animal	The Effect of Microgravity on Fracture Healing/Ultrasound as a Possible Countermeasure							2001	2002
Bone Loss	Animal	The Effects of Microgravity on Bone Osteoblast Growth	1995	1996						
Bone Loss	Animal	The Effects of Partial Mechanical Loading and Ibandronate on Skeletal Tissues in The Adult Rat Hindquarter Suspension				1998	1999	2000		
Bone Loss	Animal	Transcriptional Regulation of Differentiating Osteoblasts				1998	1999	2000		
Bone Loss	Animal	Transgenic Markers of Bone Cell Lineage Progression		1996	1997	1998	1999	2000		
Bone Loss	Animal	Use of GTP Transgenes to Assess Osteoprogenitor in Intact Bone (This Task began in FY 2001)						2000	2001	2002
Bone Loss; Food & Nutrition; Clinical Capabilities	Animal	Role of Vitamin E in Preventing Oxidative Damage to Bone in Near Weightlessness; The Role of Vitamin E in Preventing Oxidative Damage to Bone in Near Weightlessness and its Effects on Bone Quality During Recovery (This Task began in FY2000)					1999	2000	2001	
Bone Loss	Human	Biomechanical Countermeasure for Disuse Osteopenia								2002
Bone Loss	Human	Bone Strain During 0G Exercise						2000	2001	2002
Bone Loss	Human	Cause and Treatment of Nephrolithiasis and Osteoporosis in Space				1998				
Bone Loss	Human	Characterization of an Osteoblastic Scavenger Receptor			1997	1998				
Bone Loss; Muscle Alterations & Atrophy	Human	Defining and Preventing Bone Loss: A Model for Microgravity							2001	2002
Food & Nutrition; Bone Loss	Human	Dietary Oxalate and Stone Risk			1997	1998	1999			
Bone Loss	Human	Effect of Skeletal Unloading on Bone Formation; The Effect of Skeletal Unloading on Bone Formation	1995	1996	1997	1998	1999	2000	2001	2002
Bone Loss	Human	Effects of Integrin-Extracellular Matrix Adhesion in Fluid Shear-Induced Prostaglandin Metabolism in Osteoblasts							2001	2002
Bone Loss; Muscle Alterations & Atrophy	Human	Effects of Resistance and High-Impact Training on the Musculoskeletal System in Premenopausal Women			1997	1998				
Bone Loss; Cardiovascular Alterations; Muscle Alterations & Atrophy	Human	Exercise Within LBNP to Produce Artificial Gravity	1995	1996	1997	1998	1999	2000		
Bone Loss; Muscle Alterations & Atrophy	Human	Lower Limb Response to Impact Loads in 1G and Micro-G		1996	1997	1998	1999			
Bone Loss	Human	NCC2-5373 Microarray Analysis of Microgravity-Dependent Gene Expressions in Normal Human Fibroblasts							2001	2002
Bone Loss	Human	Non-invasive Investigation of Bone Adaptation in Humans to Cumulative Daily Mechanical Loading					1999	2000	2001	2002
Bone Loss; Clinical Capabilities	Human	Noninvasive Monitoring of Bone Resorption and Sweat Calcium Using Skin Patches					1999	2000	2001	
Bone Loss; Cardiovascular Alterations	Human	NSCORT: Integrated Physiology	1995	1996	1997	1998				
Bone Loss; Human Behavior & Performance	Human	Postural Effects on PTH, Calcium, and Skeletal Dynamics	1995	1996	1997					
Bone Loss; Clinical Capabilities; Muscle Alterations & Atrophy	Human	Prevention of Bed Rest Osteoporosis: Resistive Exercise			1997	1998	1999	2000	2001	2002

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Bone Loss; Muscle Alterations & Atrophy	Human	Prevention of Microgravity-Induced Stone Risk by KMgCitrate							2001	2002
Bone Loss	Human	Short-term Time Course Skeletal Responses to High Intensity Physical Activity					1999	2000		
Bone Loss	Human	Skeletal Adaptation to Physical Activity	1995	1996	1997	1998				
Bone Loss	Human	Skeletal Structural Consequences of Reduced Gravity Environments				1998	1999	2000		
Bone Loss; Muscle Alterations & Atrophy	Human	The Biomechanics of Exercise Countermeasures	1995	1996	1997	1998	1999			
Bone Loss	Human	The Effect of Hypergravity on Bone Cell Cultures			1997	1998	1999	2000	2001	2002
Bone Loss; Clinical Capabilities	Human	Vitamin D RDA from Supplement of Light		1996	1997	1998	1999			
Bone Loss	Other	A Non-invasive Scanning Confocal Ultrasonic Diagnostic System for Bone Quality							2001	2002
Bone Loss	Other	Acoustic Bone Mass and Trabecular Property Measurements	1995	1996	1997	1998				
Bone Loss; Muscle Alterations & Atrophy	Other	Advanced, Multiple Projection, Dual Energy X-ray Absorptiometry (AMPDXA) Scanning System							2001	2002
Bone Loss; Multi-system (Cross Risk) Alterations	Other	Cloning and Functional Characterization of Novel Genes Whose Expressions are Microgravity-Dependent in Normal Human Fibroblasts; NCC2-5374 Cloning and Functional Characterization of Novel Genes whose Expressions are Microgravity-Dependent in Normal Human Fibroblasts						2000	2001	2002
Bone Loss; Clinical Capabilities; Muscle Alterations & Atrophy	Other	Compact, High Precision, Multiple Projection DEXA Scanner				1998	1999	2000		
Bone Loss; Clinical Capabilities	Other	Dual-Energy System for Precision Bone Mineral Densitometry and Diagnostic Radiography; Dual-Energy X-Ray System for Bone Mineral Densitometry and Diagnostic Radiography; Dual-Energy X-ray System for Precision Bone Mineral Densitometry and Diagnostic Radiography (This Task began in FY2000)					1999	2000	2001	2002
Bone Loss; Clinical Capabilities	Other	Non-Invasive Monitoring of Physiological Analytes						2000	2001	
Bone Loss; Clinical Capabilities	Other	Non-Invasive Monitoring Through Transdermal Sweat Detection					1999			
Bone Loss	Other	Novel Approaches to Establishing Validity and Reliability of Mechanical Response Tissue Analysis: Technology for Evaluating Structural Integrity of the Tibia								2002
Bone Loss	Other	Pressure-Sensing MAP Kinase Cascades in Yeast and Mammals; Rice NSCORT in Gravitational Biology: Pressure-Sensing MAP Kinase Cascades in Yeast and Mammals				1998	1999	2000		2002